THURSDAY, DECEMBER 23, 1915.

THE "WHEAT PROBLEM" AND SYNTHETIC NITRATES.

MANY years have elapsed and much water has flowed under the bridges since Sir William Crookes startled a heedless world by an address, delivered in his capacity as president of the Bristol meeting of the British Association, in which he drew a somewhat alarming picture of "the serious peril awaiting wheat-eaters who contentedly pursue the present wasteful system of cultivation." He stated that in his opinion under present conditions of culture a scarcity of wheat is within appreciable distance; that wheat-growing land all over the world is becoming exhausted, and that at some future time—in his opinion not far distant—no available wheat land will be left. The prediction was as doleful as the prospect was disquieting; but fortunately the remedy was comparatively simple and it was near at hand. As the president pointed out, Nature's resources, properly utilised, were ample. The remedy consisted in a more scientific cultivation and, in particular, in the application of so-called chemical manures, whereby, by moderate dressings, the then average world-yield of 12·7 bushels per acre would be increased to 20 bushels —"thus postponing the day of dearth to so distant a period that we, our sons, and grandsons may legitimately live without undue solicitude for the future."

The main contention of this address was not allowed to pass without vigorous criticism, and a year later Sir William Crookes returned to the charge with a small volume[1] in which he set out in greater fulness the data on which his conclusions were based, with, however, the depressing result that he was unable, in any material degree, to modify his estimates of the future producing capacity of the wheatfields of the globe.

The whole question is of particular interest at this present juncture, when the production and distribution of wheat have been seriously affected by the convulsion which has overtaken the world. Large areas in Europe have for a time gone out of cultivation, and other districts, as in Russia and Rumania, are precluded from bringing their supplies to the world's markets. A vast economic disturbance has resulted in an extraordinary and altogether abnormal inequality of prices. Perhaps no valid comparison is possible between a world at peace where economic causes reach their legitimate and natural effects, and a world at war when almost every economic law is broken or set at defiance. Still, it would be reassuring to know that, in spite of the forebodings to which "The Wheat Problem" gave rise, measures are being taken to dispel them. As already stated, Sir William Crookes revealed to a prospectively famishing world how it might escape the horrors of starvation. "Starvation," he said, "may be averted through the laboratory. Before we are in the grip of actual dearth, the chemist will step in and postpone the day of famine." How was he to do it? By a "dominant" manure—in this case some form of fixed nitrogen.

Now, whatever may be the real interpretation of the facts to which we have referred, or whatever the intrinsic merit of the arguments based upon them—and it cannot be said, even after the lapse of the seventeen years which have intervened since the address was delivered, that the question has been definitely settled—it is common ground that a wheat supply may be materially enhanced by the intelligent application of nitrogenous manures, one of the most important of which is sodium nitrate or so-called Chile saltpetre. This fact is universally recognised; but it is not so generally understood that the present natural sources of sodium nitrate are by no means limitless. Even now the rich beds in the rainless districts in the northern provinces of Chile between the Andes and the coast hills have been nearly worked out. It is true that when the raw "caliche," containing from 25 to 50 per cent. nitrate, is exhausted at no very distant date, there is a lower grade of material which may be worth working. But the broad fact remains, and we cannot escape from it, that the time is approaching when we must seek some other sources of supply. So far as we know, the world has no other sources of the naturally occurring product than Chile. We must therefore look to the laboratory, and we have a confident hope that the chemist will not fail us. The synthetic production of nitrates, adumbrated by a scientific use of the imagination, so far back as 1898, is now an accomplished fact and a commercial possibility. Processes are at work in various countries, and Germany, we are told, is now independent of all outside sources of nitrates, and her manufacturers have made such

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[1] "The Wheat Problem." By Sir William Crookes, F.R.S. (London: John Murray, 1899.)

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terms with their Government that they have been able to establish a permanent industry protected from outside competition.

In the meantime, so far as we have been able to gather, this country is doing nothing in this matter. It may be that it is incapable of doing anything, as natural conditions may be against us. But it is difficult to see why we are worse off in this respect than Germany. Energy can be produced as cheaply in this country as in Germany, if not cheaper, and the problem as a commercial matter is largely a question of cheap electrical energy. We have the same ample supply of nitrogen and oxygen in our atmosphere as Germany, and soda is at least as cheap with us.

The whole question needs systematic examination, and it is the object of this article to commend it to the careful and serious consideration of one of the scientific committees which have been established since the outbreak of war. There is surely no more pressing or important problem in the interests of the future welfare of this country, intimately bound up as it is with the prosperity of our agriculture, the oldest and most vital of our industries. We have amongst us men—chemical engineers and electrical engineers—who can deal adequately with this subject, and they could confer no greater national benefit than to enlighten the manufacturing community concerning the possibilities of the synthetic production of nitrates in this country as a commercial enterprise, after a careful and impartial consideration of all available facts.

This is a matter which intimately concerns the Board of Agriculture, and it might appropriately be considered by the Departmental Committee appointed by the president of the Board a few weeks ago "to make arrangements with a view to the maintenance, so far as possible, of adequate supplies of fertilisers for the use of farmers in the United Kingdom." We do not recognise a chemist among the members of the committee, and conclude, therefore, that the possibilities of producing a supply of synthetic nitrates are not to be contemplated. If the omission is deliberate, we suggest that the subject should be taken up by the British Science Guild, or by one of the committees recently appointed by the Government and by scientific societies, so that a definite view of our national position in this matter may be presented and provision may be made for any eventualities which the future may bring, either during the war or in later years.

THE FAUNA AND FLORA OF CENTRAL AMERICA.

Biologia Centrali Americana. Zoology, Botany, and Archæology. Edited by F. D. Godman and O. Salvin. (London: Dulau and Co., Ltd., 1879–1915.)

THE first and last volumes of this magnificent work have recently appeared, and as it is impossible to review adequately sixty-three volumes, even if one took up several numbers of NATURE, the following attempt will be confined to the first or introductory volume, which has recently been issued under the editorship of Mr. Godman.

When this great work was first planned it was estimated that the zoological part would not exceed twelve volumes of five hundred pages each, and that four volumes would suffice for Botany; the inclusion of the Archæology was not at that time contemplated. These sixteen volumes have, however, swollen into sixty-three volumes, including a most valuable contribution by Mr. A. P. Maudslay on the archæology, ruins, and inscriptions of Yucatan.

It is not unusual for a rich patron—a modern Mæcenas—to subsidise publications on an extensive and even lavish scale. It is less usual to find the patron and investigator in one and the same man, but, in fact, it is mainly due to the public spirit and the scientific ardour of Mr. Godman that this very important contribution to biological science has been so successfully carried through.

Godman and Salvin belonged to a small group of Cambridge undergraduates who, in the middle 'fifties, took a keen interest in natural history. In the neighbouring and then undrained fenland they once even chased a buzzard, and "were just too late to catch the 'large copper,' recently become extinct." These youthful naturalists were wont to meet in each other's rooms and discuss their various "finds," and, indeed, it was in Newton's rooms at Magdalene, towards the end of 1858, that Salvin, Simpson, Wolley, Slater, Newton, and others met and passed a resolution founding the Ornithological Union, the journal of which, *The Ibis*, has now reached its fifty-sixth volume.

Salvin had already travelled in northern Africa and northern Europe when in 1857 he paid his first visit to Central America, and first became acquainted with the collectors who were then active in these regions. Two years later he returned again; and two years afterwards Godman joined Salvin on his third expedition to Guatemala. Again in 1867, accompanied by his wife, Salvin returned for a fourth time to Guatemala, and after

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